**U.S. Army Research Institute
for the Behavioral and Social Sciences**

Research Report 1809

Training and Training Technology Issues for the Objective Force Warrior

**Erik Zipperer
Gerry Klein
Ray Fitzgerald
Henry Kinnison**
The Wexford Group International

Scott E. Graham
U.S. Army Research Institute

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ZITA M. SIMUTIS
Director

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14. ABSTRACT *(Maximum 200 words)*:
The Objective Force concept calls for combining what is best from conventional and Special Operations Forces (SOF) cultures. This work identifies successful SOF training approaches and training issues that are potentially appropriate for training Objective Force Warrior (OFW) dismounted combatants and small units. A training questionnaire and detailed interviews were given to nine senior active duty and recently retired NCOs who were chosen for their combat experience, instructor time, and extensive SOF experience. Supplementary interviews were conducted with subject matter experts from the Infantry School and retired officers and NCOs working in high-risk training occupations such as law enforcement special weapons and tactics instructors, security and protective services, and medical professionals. The report contains four complementary sections: OFW relevant SOF training and training technology issues; SOF training techniques for various operational specialties; a listing and description of high-risk/high performance military related trainers in the private sector; and training technology vendors for the areas of sustainability, mobility, survivability, lethality, and situation awareness. The training and training technology issues discussed include time management, command of the basics, skill mastery, combat-focused training, visualization, emphasis on appropriate repetition, and the use of simple aids.

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Erik Zipperer, Gerry Klein, Ray Fitzgerald, Henry Kinnison
The Wexford Group International

Scott E. Graham
U.S. Army Research Institute

Infantry Forces Research Unit
Scott E. Graham, Chief

U.S. Army Research Institute for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria, Virginia 22333-5600

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This report is the initial product from a Science and Technology Objective (STO) entitled *Training Objective Force Small Unit Leaders and Teams.* The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) Infantry Forces Research Unit is performing this research in conjunction with ARI Simulation Systems Research Unit. The goal of the STO is to help the Army determine what to train, how to train, and how to measure success of training in preparing small unit leaders and teams to take better advantage of new Objective Force capabilities, operational concepts, and tactics, techniques, and procedures (TTPs).

This report supports the Objective Force vision for a culture change in which there is a synthesis of the best from the conventional and Special Operations Forces (SOF). The research identified successful training techniques used by SOF units for training close combat skills that are particularly relevant for Objective Force Warrior (OFW) equipped dismounted combatants and teams. It further identified cutting edge high-risk/high performance trainers and training technology vendors that could be used for OFW training. In the remaining three years of the STO, ARI will assess the feasibility of adapting the most promising approaches and training technologies for OFW use.

This work provides the foundation for future STO products, including guidelines and draft training support packages that can be used by the OFW Lead Technology Integrator for the Advanced Technology Demonstration (ATD) train up. Critical aspects of the research were briefed to all key sponsors, including the U.S. Army Infantry School Director of Operations and Training and the OFW Technology Program Office.

MICHAEL G. RUMSEY
Acting Technical Director

TRAINING AND TRAINING TECHNOLOGY ISSUES FOR THE OBJECTIVE FORCE WARRIOR

EXECUTIVE SUMMARY

Research Requirements:

New and advanced training methods are needed to support the development of emerging soldier system technologies including those being examined in the Army's Objective Force Warrior (OFW) program. In addition, the Objective Force concept calls for combining what is best from conventional and Special Operations Forces (SOF) cultures. This work identifies successful SOF training approaches and training issues that are potentially appropriate for training OFW-equipped dismounted combatants and small units.

Procedure:

A training questionnaire and detailed interviews were given to nine senior active duty and recently retired NCOs who were chosen for their combat experience, instructor time, and extensive SOF experience. Supplementary interviews were conducted with subject matter experts (SMEs) from the Infantry School and retired officers and NCOs working in high-risk training occupations such as law enforcement special weapons and tactics (SWAT) instructors, security and protective services, and medical professionals.

Findings:

The report contains four complementary sections: OFW relevant SOF training and training technology issues; SOF training techniques for various operational specialties; a listing and description of high-risk/high performance military related trainers in the private sector; and training technology vendors for the areas of sustainability, mobility, survivability, lethality, and situation awareness.

The training and training technology issues discussed include time management, command of the basics, skill mastery, combat-focused training, visualization, emphasis on appropriate repetition, and the use of simple aids. Clearly these are not new concepts, but they do have continuing, critical relevance. SOF training techniques are discussed in the areas of weapons, breaching, fire control, combat life saving, mobility, and operations and intelligence.

Utilization of Findings:

The results have been given to the Army training developers at the Infantry school, the OFW Technology Program Office, and the OFW Lead Technology Integrator in support of the train-up for the OFW Advanced Technology Demonstration.

TRAINING AND TRAINING TECHNOLOGY ISSUES FOR THE OBJECTIVE FORCE
WARRIOR

CONTENTS

TRAINING AND TRAINING TECHNOLOGY ISSUES FOR THE OBJECTIVE FORCE
WARRIOR

CONTENTS (CONTINUED)

TRAINING AND TRAINING TECHNOLOGY ISSUES FOR THE OBJECTIVE FORCE WARRIOR

Introduction

Future soldier systems such as Land Warrior (LW) promise to greatly enhance the effectiveness of dismounted warriors and small units. The potential of emerging technologies, to include those being examined in the Army's Objective Force Warrior (OFW) science and technology (S&T) program will only be realized if soldiers, units, and leaders are trained to fully exploit system capabilities. In the past, modernization efforts have overwhelmingly emphasized the development of new materiel solutions. Recently, the focus has shifted to the "Soldier as a System" whereby doctrine, organization, training, materiel, logistics, personnel, and facility (DOTMLPF) issues are considered in a holistic fashion since no one part of DOTMLPF is independent of another in providing a total resolution to soldier concerns (US Army Training and Doctrine Command, 2002).

Central to LW and the OFW enhanced system is the soldier-worn computer capabilities that will allow soldiers to receive, adapt, and share information from an increasing variety of information sources. Teams are linked by advanced communication systems that will allow battlefield information to be pushed to and pulled by soldiers at all echelons. New navigation and night vision capabilities permit greater movement and mobility. Small units will have organic air and ground robotic capabilities, including robotic scouts and robotic load carriers. Collaborative access to organic and joint netted-fires will yield advanced lethality capabilities that will permit killing the enemy at longer ranges. There will also be a dramatic increase in the speed, accuracy and violence of short-range weapons. The OFW will also enjoy unprecedented survivability provided by improved situational understanding and an integrated combat suit that provides full spectrum protection. (Andrews, Beatrice, Brandler, and Cooper, 2002)

In addition to new technologies, there will be changes in the operational realities for which soldiers, units and trained and readied. OFW units will be expected to literally go anywhere in the world on very short notice. They will fight increased numbers of engagements in urban and restricted terrains and will be expected to rapidly accomplish their missions with limited casualties. Full spectrum operations will become the norm. OFW units must be ready to fight formal armed forces, non-governmental enemies, both paramilitary and criminal, and execute stability and support operations under high scrutiny. Also, there will be a mix of legacy force, interim forces, and the objective force systems for decades to come.

Training will increasingly focus on the development of cognitive decision-making skills, as Objective Force leaders must excel in critical thinking. They will have to possess higher order thinking skills that enable them to adjust and adapt their thinking and tactical decisions to rapidly changing operational situations and conditions. (US Army Training and Doctrine Command, 2000). Much of the critical decision-making involves the manipulation of information, and understanding what to do with it. Soldiers and leaders must not only be trained how to operate within prescribed information systems, but more importantly be trained to make informed, rapid and accurate decisions and then select the most appropriate actions based on those decisions.

They must be trained on the technical and tactical skills to leverage new technologies as well as other leader skills, including interpersonal and team skills.

As stated by the Army Chief of Staff in his Objective Force White Paper (U.S. Department of the Army, 2001), the Objective Force is erasing the distinction between heavy and light forces and that we are training conventional units using special operations techniques. Rather than trying to substitute one of the existing cultures for the others, i.e., heavy, light, and Special Operations Forces (SOF), the plan calls for the combining what is best from each community.

Of particular relevance here, the SOF community has close combat specialists who are the best in the world at urban and night operations. A major challenge is how to raise the level of close combat fighting skills in Objective Force small units to that of SOF. The Chief's plan further states that Objective Force soldiers will possess a warrior ethos built through high standards and realistic, tough, and demanding training. The present report intends to help the Army bring SOF close combat skills and warrior ethos to the Objective Force Army as a whole.

Training Objective Force Small Unit Leaders and Teams STO

The U.S. Army Research Institute (ARI) has embarked on a four-year Science and Technology Objective (STO) in support of the OFW S&T program and its culminating Advanced Technology Demonstration (ATD). The purpose of the STO is to develop new training methods and performance measures required to exploit new Objective Force capabilities and high-tech equipment. The products will include guidelines and draft training support packages that can be used by the OFW Lead Technology Integrator (LTI) for the ATD train-up. ARI will place particular emphasis on the development of guidelines for the use of embedded training. See Graham and Dyer (2002) for a discussion of embedded training and other OFW training environments.

One of the major challenges of this work concerns how to conduct relevant training research and develop prototype training support packages for systems that are under development. In this report, our approach is to identify successful training methods and technologies currently used by high performing teams in the private sector and Department of Defense (DoD) and to adapt those, as appropriate, to training OFW small unit leaders and teams. Specifically we will leverage advances in situation awareness training and measurement, tailorable training, computer gaming, and intelligent tutoring. In the area of embedded training research, ARI will subsequently examine effective methods for using wearable computers to train small unit leaders and teams. In addition, ARI will replicate OFW technology functions and information technologies and develop an embedded training test bed as a means to assess new OFW leader training strategies and techniques. This report is the first STO deliverable.

Purpose of Report

The purpose of this report is to identify issues of importance relating to training and training technology strategies for the Army's Objective Force, especially OFW-equipped dismounted combatants. Our principal approach is to capture close combat training and training

technology lessons and approaches used by SOF units. Additionally, we have sought to identify successful, efficient, high-risk/high-performance trainers and training technology vendors. Under the STO, we will assess the feasibility of each to adapt their lessons, approaches, and technologies for OFW use. There are four complementary pieces in this report.

- SOF training and training technology issues relevant to OFW

- SOF training techniques for various operational specialties

- Listing of high-risk/hign-performance trainers in the private sector

- Training technology vendors in the areas of sustainability, mobility, survivability, lethality, and situation awareness.

Method

Participants

We administered a questionnaire and conducted a detailed interview with nine senior NCOs. The NCOs were both active duty and recently retired, chosen because of their combat experience, instructor experience, and broad-based experience in various military occupational specialties (MOSs). The vast majority had extensive experience in SOF. The following is a summary of their experience level:

- Rank: Command Sergeant Major (1), Sergeants Majors (6), and Master Sergeants (2).

- Time in Service: Averaged 27 years experience in combat arms training and applications.

- MOSs Represented: Infantryman (11B), Indirect Fire Infantryman (11C), Combat Engineer (12B), Fire Support Specialist (13F), Cannon Fire Direction Specialist (13E), Special Forces Weapons Sergeant (18B), Special Forces Engineer Sergeant (18C), Special Forces Medical Sergeant (18D), Special Forces Communications Sergeant (18E), Special Forces Operations and Intelligence Sergeant (18F), Special Forces Senior Sergeant (18Z), Signal Support Systems Specialist (31U), Medical SPecialist (91B), Military Police (96B), Imagery Analyst (96D).

- Additional Specialty Schools included: BNCOC, ANCOC, RANGER, Special Forces Qualification Course (SFQC), Special Forces Combat Diver, Special Operations Training Course (SOT), Airborne, Jumpmaster, Air Assault, Military Freefall (MFF), MFF Jumpmaster, Special Forces Operations and Intelligence (O&I), Pathfinder, Northern Warfare Training Course (NWTC), Jungle Operations Training Course (JOTC), Defense Language Institute (DLI), Naval Close Air Support Courses, Advanced Land Navigation Course, Air-Ground Operations School (AGOS), Ground/Vehicle laser locator Designator Course (G/VLLD), Amphibious Warfare, USMC Sniper School,

Special Operations Target Interdiction Course (SOTIC), Drill Sergeant School, Emergency Medical Technician (EMT), Battle Staff, Sergeants Major Academy (USASMA), Advance Trauma Life Support (ATLS), Advance Cardiac Life Support (ACLS), Survival Evasion Resistance Escape (SERE).

- Combat Time: Approximately 1.5 years per soldier. Most recent combat zones: Vietnam, Grenada, El Salvador, Panama, Haiti, Iraq, Somalia, and Afghanistan.

- Hostile Fire Zone Time: Approximately 1.7 years per soldier. Examples: Lebanon, El Salvador, Columbia, Kuwait, Bosnia, Pakistan, and Kosovo.

We additionally interviewed others on related issues albeit on a less formal basis. This included:

- Contacts within the Infantry School and SMEs on the OFW Wolfpack Team.

- Retired Officers and NCOs, working in high risk training occupations such as: Law Enforcement special weapons and tactics (SWAT) Instructors, Security and Protective Services, Off Road Driving Instructors, Survival and Tracking Courses Instructors, Medical Professionals, Competitive Shooting Instructors, Mountaineering Instructors, Back Country Skiing Instructors.

Questionnaire and Interviews

The questionnaire (Appendix A) and interviews focused on new approaches to train soldiers to perform complex individual, team, and leader tasks. The questions and discussions centered on training, technologies, and techniques used to accelerate and streamline the learning process. Our primary focus was on non-commissioned officers (NCOs) and soldiers who execute close combat and close quarters battle (CQB) roles within the Army. This includes the infantry, artillery, combat engineers, medics, and special operations soldiers.

More specifically, the interviewees were asked to describe training techniques that prepared soldiers and small units for efficient and effective task accomplishment under life-threatening, fast-paced and stressful conditions. SMEs were asked to describe their training philosophy and training approaches. They were also asked to give examples of other successful trainers' techniques used to improve the effective employment of new systems and procedures. The interviewees were asked to describe the techniques SOF units used to train various specialized areas (e.g. weapons, breaching, and combat life saving).

The questionnaire and interviews were conducted between May and December of 2002. Some of the interviews were conducted in conjunction with other projects and all participants were guaranteed anonymity. In general, there was a fairly loose structure to the interviews. The primary purpose was to solicit information on successful SOF training approaches and to elicit creative ideas, and to a lesser extent produce quantitative results.

4

Training Issues

These issues represent an integration of participant comments made on the questionnaire and during the interviews. The issues identified are those of the nine principal SMEs, other SMEs from throughout the Army, and the high-risk/high-performance trainers that support the Army with specialized instruction. The initial intent of this project was to identify cutting-edge training technologies used by high performing units, especially SOF units. Somewhat surprisingly, the questionnaire and interview responses by the SMEs tended not to focus on training technologies per se, but on successful techniques and approaches that they had used. Their insights do, however, reflect thousands of hours of instruction, application of training, and of leading soldiers in combat and combat training exercises. The order in which the topics are presented represents a loose prioritization of their perceived importance.

Training Time

Maximizing the amount and value of training time was identified as the top issue. Time is the most critical resource that leaders manage. Time that is wasted or lost cannot be replaced without sacrificing another event in the future. Whether it is training, recovery, or stand down, something will have to be omitted to accomplish what the soldiers failed to accomplish during the original allotted time. Trying to recover lost training time means altering the training schedule and impacting on others' schedules as well.

The introduction of new equipment and technologies greatly impacts the amount of available training time. Units receiving new equipment may require so much time to learn the operations of that equipment that they do not have sufficient time to train on critical individual and collective mission essential tasks.

Training distracters, which are typically pushed down from higher echelons, are perhaps the greatest impediment to small unit training time. This is sometimes referred to as "violation of white space," which refers to the unfilled space on the unit training calendar. The first items to fill the training calendar come from corps, division, brigade, and battalion respectively, including a host of mandatory Army training (e.g., drug abuse, gender relations, and Geneva Convention training). Small unit training time is that which is left. Too often there is little or no time left for squad/platoon training.

Mandatory training presents another problem, as the unit leadership often must be present, including during make-up training times. This places an additional burden on the time available for small unit leaders to conduct combat-focused unit training. This is not to say that mandatory training topics are unimportant, but that a comprehensive assessment should look at their overall impact. Perhaps Geneva Convention training might be done as "hip pocket training," i.e., when opportunity permits, with larger blocks of time being dedicated to training small unit field craft. It was suggested that there needs to be a closer relook or cleansing of required training topics.

Much of the training white space is taken up by post support. This was described as one of the main training distracters. This includes activities such as funeral details, gate security,

cutting grass, installation and range cleanup, storm damage pickup and drivers and escort duties. Post support requirements not only impact enlisted soldiers, but officers as well (e.g., commissary inventories). The frequency, and hence the negative impact, of post support is even greater with divisions or posts that only have two brigades. Not only does post support take away from training time, but the interviewees also believed post support had a significant negative impact on reenlistment. Soldiers joined the Army for tough realistic training, not to pick up pinecones.

All of the interviewees experienced the negative impact of training distracters. They suggested that efforts are needed to ensure that training schedule changes initiated at one echelon only affect that echelon's training, and not that of the subordinates. That is to say, when a battalion commander decides to change the battalion training schedule, it should only impact the allotted battalion level training time. Subordinate elements should be given the same flexibility and guidance. Small units and individuals form the foundation of any organization and must master their skills or the higher level will falter. It is essential that they receive sufficient time to train those skills. Suggestions were offered to help alleviate and actually learn from this problem. In the minds of those interviewed, there is a clear correlation between the amount of day-to-day training distractions and ultimately the amount of uncertainty during fast-paced combat operations.

The interviewees recognized that changes and distractions to the training schedule are inevitable. The goal is to make the best out of those changes. However undesirable change might be, all the interviewees believed the trainer had to expect and be prepared for changes in training. Typical comments included:
"Changes can adversely impact training time and one must expect it and deal with it;"
"Train the most critical tasks first;"
"Integrate change into the training day;"
"Don't make any training 'notional'."
Small unit trainers should be prepared to use all distracters as training opportunities. For example, if the vehicles planned for movement do not show up, execute the "bump plan" immediately. For example, conduct a forced march. Or if one of your four trucks breaks down, make the troops decide how they best can continue to operate (e.g., what do they leave behind? Where do they place their crew served weapons?). If a weapon breaks, continue the mission as if it malfunctioned in combat and realign assets accordingly.

Opportunity training or the old "hip-pocket" training was designed to address these issues. It was felt that techniques for executing hip-pocket training needed to be better emphasized and improved. Small unit leaders should be prepared to deliver short 15-20 minute training sessions in the "cracks" (e.g., have soldiers pull out their compasses for a quick lesson/review on compass use). One of the reasons why hip-pocket training is no longer as prevalent are that printed copies of the Soldier Manual of Common Tasks (SL1) are no longer available. Elimination of soldier job books is another. Job books were described as a great tool for squad team leaders to plan and direct hip-pocket training.

Training management is critical. Leaders must learn how to manage their time and resources efficiently and wisely. It was suggested that leadership and institutional training

should place a greater emphasis on training management. Despite the great importance of time management, it was said that there is only one four hour block on training management in the Infantry Captain's Career Course. Several noted they were able see the positive impact of leaders learning "how to train" during Desert Storm. One of the main reasons units performed so admirably was that leaders were given a month (28 days continuous training, with two days stand down) to train their units, with no post support requirements, and readily available ammunition. While there were centralized brigade and battalion training plans, the actual execution was decentralized (i.e. left to the small unit leaders for execution).

Another training distracter comes from the personnel requirements related to simulation-based training. Many of the current simulation training technologies require significant personnel overhead. In the past, higher echelons command post exercises (CPX) only required the leaders to participate. Now the simulation exercises require lower echelon leaders and support personnel (i.e., "puckers" to input information and manipulate the simulated forces). These soldiers and leaders must not only be there during the CPX simulations, but also must be trained to work with the simulation. In some cases this creates a significant burden. While much is learned about the execution of collective tasks, the soldiers are deprived the training time required to master the individual skills that support the collective task. They understand why collective tasks are executed, but they do not know how to execute the individual skills that comprise the collective task.

Future training technologies and simulations should reduce additional manpower requirements, not increase them. As it stands, there is high demand placed upon unit leadership to support today's simulation-based training exercises. As a result, unit leadership is not available to conduct multi-echelon training with their unit while supporting the concurrent exercises. There is, however, a real need for true multi-echelon training in which leaders at all echelons can train concurrently with their subordinates. Several questioned the true cost-effectiveness of large training simulations. They were skeptical as to whether all of the personnel costs (e.g., contractors, supporting unit personnel, were included in the cost-effectiveness analyses). The overriding message was that if the Army wants leaders to properly train their units, they must teach them how to train, how to manage their time, and give them the resources that are needed to do so. The 40-hour Battalion Training Management System (BTMS) course was seen as a great tool that taught all levels of the chain of command their role in assessing, planning, and the execution of individual and collective training.

Training Time Issues.

- How can we reduce the number and frequency of training distracters? What innovative approaches or technological advances can be used to minimize the negative effects of training distracters?

- What can be done to shorten the learning curve for new equipment, technologies, and procedures? What can be done to smooth the transition from one system or technique to another?

- What are effective techniques that trainers can use to quickly adapt to changes and still conduct useful training? For example, how can leader re-institute effective hip pocket training?

- What can be done to reduce post support requirements? Can alternative labor sources (e.g., contractors or prisoners) be used for post support?

- What is a reasonable tradeoff between newer high-tech and expensive weapons systems and increased funding for training?

- Can we develop multi-echelon training simulations that allow leaders to train their units simultaneously at all echelons?

- Are there more effective ways to train and reinforce training management skills, including time management?

Training Time Quotes

"Time is the one resource that cannot grow."

"Take ownership of training time."

"Train spontaneously. Make the training distraction a positive training event."

"We do not manage training time efficiently."

"Time must be used wisely -- time wasted is time lost!"

"Don't waste time on things that don't pertain to the skill being trained."

"Boredom affects the learning curve...it slows the learning curve; don't prolong training just for the sake of training for "X" amount of time."

"Train to standard not to time."

Training the Basics - Crawl

The overwhelming belief was that training should be structured such that soldiers who are being trained on new skills learn the fundamentals or the "basics" first. Lower levels of proficiency need to be built before moving forward with technological tools or shortcuts. Soldiers should only move to higher levels when proficiency is established and standards are reached. This was repeatedly

reinforced throughout the interviews. The SMEs agreed the traditional "crawl - walk - run" model was important, appropriate, and still applied. Soldiers must first understand the foundations of a skill (i.e., the science) before moving on to the art.

While technology may enhance a soldier's ability to perform a task, it often reduces the soldier's need to understand the basics, especially for performing at minimum levels of proficiency. In other cases, technological tools may eliminate the need for soldiers to perform certain tasks altogether (e.g., the use of electronic troubleshooting tools replaces the need for manual diagnostics). While technology alone may assist basic proficiency, understanding the fundamentals is often required for advanced or expert levels of performance. Understanding the fundamentals is required in degraded situations when the technology may not work. It was suggested that soldiers who lack an understanding of the fundamentals have greater difficulty developing field expedient solutions.

The SMEs thought the most important factor for being a successful instructor was understanding the fundamentals of skill proficiency. They said while this seems obvious and oversimplified, not understanding the rationale or the "academics" of performing was often the primary reason instructors were not successful. While technology can often be used to aid instructors with training, it is important that the trainer does not let the technology blindly perform his or her job for them. Several examples were given regarding this point in the case of marksmanship training. Location of miss and hit (LOMAH) targets can be a powerful tool, but a good instructor must still diagnose a shooter's problem and provide corrective instruction. Likewise, it was mentioned the Engagement Skills Trainer 2000 provided excellent feedback, but instructors needed to learn how to use information to augment and not replace their instruction.

When soldiers become reliant upon technology to perform their tasks, they lose their ability to execute the task in the absence of technology. Those who do not learn the basics of a skill and just rely on dogmatic practices and doctrine don't understand the "why factor." As a result it is less likely they will grow to where they can apply the full range of capabilities that a technology offers. Unless one understands the why and how something functions, it is difficult to explain it to or to train others. That is one of the reasons that units have trouble sustaining new equipment training as new members join the unit. Technology may inadvertently change procedures, with resulting negative effects. For example, prior to the fielding of secure radios, short communications were necessary and required. Leaders used brevity codes and Pro words to rapidly communicate. Now because of secure radios, there is less radio discipline and communications tend to be much longer and less succinct.

A good training approach is to build the core fundamentals of each task separately, and then gradually incorporate additional tasks. It was suggested that the training of fundamental skills should be conducted first without distraction, then tasks should be broken down to basic elements or subtasks. Training should focus on building proficiency in the subtasks that add up to the whole. It was strongly recommended that sustainment or refresher training always begin with a review of the fundamentals.

Another potential problem surrounds the cost, availability, and fragility of some new high-technology weapons and tools. It is imperative that the high-tech weapons and tools are available for training. If soldiers are unable to train with the actual technology, it is unlikely they will ever be able to realize the full potential provided by the technology. It was thought that soldiers do not reap the full benefit of certain technologies because both they and their leaders never learn how to properly employ

9

the tool. A similar situation is when there is a push to accelerate the fielding of new technologies after units have been deployed (e.g., in Desert Storm or Afghanistan). Soldiers do not have enough time to become fully familiar with a system's functionality or procedures. One example cited was that some soldiers were issued thermal sights after deployment in Desert Storm. Even though thermal sights are a great technology, they proved to be of somewhat lesser value because of the unit's lack of experience with them.

The SMEs generally that agreed when the Army fields new technologies, it must make sure that the trainers and the lowest echelon leaders sufficiently understand the fundamentals. Only then should they train on specific tasks, conditions, and standards. Visualizing or thinking through the opportunities a new technology or procedure provides was offered as a technique to improve task execution. When soldiers receive new technologies, they commonly adapt and innovate, but too often this knowledge is not shared with other units or even with subsequent leaders in that unit. It was felt there should be a better attempt to capture practical lessons learned about unit standard operating procedures (SOPs) and tactics, techniques, and procedures (TTPs). One SME said that based on his experience even in very well trained, high-performing units like the Ranger Regiment that the "tribal knowledge" gained on how to best employ new technologies (e.g., night vision equipment) was rarely shared between companies.

One suggestion for improving the development and sharing of new TTPs was to establish a "test unit." For the OFW program, a test unit would allow spiral development of TTPs to accompany and complement spiral development of system hardware and software. A test unit would allow TTPs to be tested, refined, and validated in time for fielding of the new system. It was also suggested there needs to be improvement in the development and documentation of new equipment TTPs. Several of the interviewees noted that institutions are generally reluctant to make significant changes to doctrine. Those tasked with writing new TTPs and related doctrine are often not those who have worked closely with the developing system. In part this is due to the practical limitation that only so many can participate in system development. In any case, it was thought that the process of capturing, developing, and sharing new innovative procedures was generally not effective or efficient. While spiral development of TTPs is necessary, the SMEs warned that soldiers and units must be careful not to prematurely change unit SOPs or TTPs based on the characteristics or idiosyncrasies of technology prototypes.

A typical combat operation problem is the late issuing of new technologies that are purchased or otherwise procured in the last days or hours before combat operations. These last minute "urgent" deliveries to deploying units are common. Failure to train on the basics of new equipment operating procedures, or even the storage of this new equipment can lead to deadly results.

Training the Basics Issues.

- What are the most effective and efficient methods for training the fundamentals skills required for various types of emerging systems? Which fundamental knowledge and skills are most important?

- What are the most effective techniques for transforming an understanding of the basics into expert performance?

- What can be done to ensure instructors and unit trainers understand the necessary fundamentals? What are effective train-the-trainer tools for assisting instructors in teaching both the basics and more advanced skills?

- Can high-fidelity simulators be built to reduce the impact of limited availability of expensive systems? Is this prudent and cost-effective?

- What training approaches can best support the post-deployment fielding of new systems?

- How do we develop soldiers and units to be innovative in their application of new system capabilities?

- How can we facilitate rapid development and validation of TTPs for new systems? How can we effectively disseminate innovative SOPs and applications between units?

Training the Basics Quotes

"Build lower element proficiency first, move to higher levels only when proficiency is established."

"Break tasks down to basic elements, and focus on building proficiency in subtasks."

"Build upon the core fundamentals of each task separately, gradually incorporating additional tasks."

"Reinforce basics and rerun dynamics until successful, continue increasing contingency training for skill enhancement and sustainment with prudent decompression, after action reviews and critiques."

"Focus on the basics, train with realism, train every day, train to standard, train repetitive, and be consistent in training."

"Know the basics cold. Just prior to, or during the mission, is not the time to think about basic skills, but about more complex tasks."

"The Army treats trainers as a 'goes with the job' skill akin to leadership. This is a fallacy. Our training manuals don't teach training fundamentals to good education. They teach methodology that is often only effective for a few."

Skill Mastery – Walk and Run

Once the basics are mastered, technology should then be introduced. As individual and collective proficiency increases, the pace of training should accelerate. In most cases that means the conditions for task performance are made more difficult. Training should first ensure that standards

can be met. Then the standards should be exceeded. For all new technologies, related standards must be determined, evaluated, and confirmed. Making conditions more difficult is a way to improve proficiency. Trainers can, for example, conduct training in various conditions of light, weather, wind or change the soldier loads to increase task difficulty and to replicate combat conditions. Tougher conditions create a greater challenge.

Good trainers know how to accelerate the pace or increase the difficulty of conditions to get optimum increases in performance. Factors affecting the optimum rate include: the technology, the simplicity of the task, the student's ability, instructor-to-student ratio, available training time, and safety. The SMEs agreed that picking up the pace and increasing the stress through timed or physically challenging events is an excellent means to make it more difficult to reach the standard and ultimately to reach high levels of performance. The interviewees mentioned excitement, challenge, enjoyment, and exhaustion with a sense of accomplishment as means to increase retention of a learned skill.

While the traditional approach is to hold standards constant and increase the difficulty of the conditions, it may be feasible to tie the standards to available technology. For example, there are certain standard for navigating with a compass and different standards when using a precision lightweight GPS receiver (PLGR). Another way of looking at this is how does the technology affect the performance of the task. In this sense, the technology is part of the condition, something the soldier is given to conduct the task.

It was suggested that each training session begin with a review and a warm-up period then progress to scenarios with greater excitement and realism as proficiency levels permit. The SMEs felt that although current training doctrine and standards allow this, in many cases it is not accomplished due to "excessive safety paranoia, not concern." It was also said that there are often safety issues because troops and leadership seldom come out of the "crawl" stage. In part, this referred to the lack of actual tactical training that soldier and units receive. For example, to make the rank of sergeant at the three-year mark, it was estimated an enlisted soldier received only four to six months of tactical, "warfighting" training. By contrast, in a 24-month tour, it was estimated Rangers received 20 months of tactical, "warfighting" training. Limited amounts of challenging field training were cited as a negative factor in retention. Boredom sets in, troops do not feel challenged, and they look for excitement and challenges elsewhere.

For soldiers and units to reach the highest levels of proficiency, the SMEs believed the training should focus on the hardest collective tasks that incorporate the greatest number of critical individual tasks. Other tasks will seem easy by comparison. Some of the more difficult tasks identified, or ones that are normally trained less frequently, include: casualty evacuation, avoiding fratricide, logistics/resupply, defense, NBC conditions, controlling fires, keeping out of minefields, and dealing with civilians on the battlefield. For top proficiency, units should train to success in worst-case scenarios. This might include training under cold and wet conditions with low initial levels of ammunition. Another suggestion was to pay serious attention to rigorous execution of casualty evacuation during MILES exercises. A related suggestion was to make MILES casualties return to other units, which would give the receiving units experience incorporating new personnel. It was believed that leaders should make every effort to set competitive goals and to foster the spirit of competition as much as possible. When a standard is met, the goal should be set to exceed the standard and to overall increase combat effectiveness.

Another approach for obtaining higher levels of proficiency is to frequently introduce the element of "surprise" into training. Soldiers and units must be trained to prepare for surprise, which is nothing more than contingency planning or anticipation of the unexpected. Trainers should, however, avoid inserting "surprises" into their training until after their soldiers have mastered basic tasks. Once basic task mastery is established, trainers should insert contingencies that demand creative thinking into the training events. Soldiers should be trained to perform the task in the context of situations that had not been planned or expected. One example given would be to have an aircraft go down during exfiltration. The soldiers and small units would then be forced to conduct an "escape and evasion" exercise when they thought they were returning to base for stand down. A second platoon or small unit could be given the mission to track and capture the evading unit.

Training Advanced Skill Mastery Quotes

"Integrate stress when base proficiency is established."

"Drive home the basics, and then teach the shortcuts, never teach the shortcuts first."

"Risk taking is acceptable – Gambling is not!"

"Push the student past his comfort zone…take risks with the appropriate level of safety net."

"It is important to go to your limit and to stretch the comfort level. In combat you are past your comfort level, but you can't quit."

"How can the learning process be accelerated? By conducting complicated scenarios; exercises that are tough and realistic"

Training Skill Mastery Issues.

- What techniques are available to create more stressful, realistic, challenging training? How can new training technologies help create more stressful training?

- What level of stress is optimal for developing skill mastery under various conditions? What tools are needed to assist trainers in determining and creating appropriate levels of stress?

- When new technologies or systems are introduced, how can we anticipate the impact they will have on training individual and collective tasks?

- Should performance standards be tied to available technologies? Alternatively, how does the technology affect the performance of the task?

- As new training techniques are being developed "bottoms-up" in various units throughout the Army, how can the successful techniques or adaptations be captured, assessed, and rapidly disseminated to other units?

- What training technologies are needed to reduce the time to mastery and to facilitate retention of mastery level skills?

- What levels of risk in training should leaders take? How can the Army ensure leaders are training with appropriate levels of risk?

Combat-Focused Training

A major point made by the SMEs was that training should always be combat focused. Training must routinely push soldiers and immerse them in realistic, challenging tactical environments. Training events must include integrated stressors and a depth of realism down to the individual level. To the extent possible, nothing should be notional (i.e., no notional smoke, no notional fire support, no notional casualty evacuation). The interviewees were serious about "Train as you fight."

Once soldiers and small units are of out of the "crawl stage," training should be executed with full emphasis on combat application. When learning basic skills, soldiers, leaders and trainers should ask themselves…is this realistic? Is this how it will be in combat? Can I do this task under combat load? Can this be done with a helmet, from the prone, etc.? Units should train on all aspects of a mission: infiltration, movement to the objective, actions on the objective, exfiltration, and contingency plans.

Emphasis should be placed on "worse case scenarios" and "surprises." Troops should be pushed to exhaustion; then when they least expect it… surprise, they are tasked to go further, faster, and fight harder, to accomplish the next mission. These were common themes throughout the interviews. "Hands on" training exercises should include live fire, live explosives, heavy loads, medical treatment, evacuation drills, and fast-paced combat operations. The SMEs did not think that these conditions are particularly well replicated with simulations.

Simulations were, however, cited as an effective means for training precursor skills. One of the primary concerns cited about the growing use of simulations was that they inaccurately represent real world conditions. For example, in comparing live fire training to MILES engagements, there were differences cited as to weapons handling, engagement ranges, speed, and velocity differences. It was noted, however, that simulations, MILES engagements, and paint-ball training (e.g., simunitions) can add a certain level of realism that cannot be accomplished through live-fire scenarios. The predominant theme, however, was that nothing replicates actual combat conditions. The key is to find the correct balance between simulation-based training events and live training as these combinations can address most, if not all contingencies. The interviewees agreed that, when possible, training should culminate with live exercises, as simulations cannot adequately represent the danger of wartime.

<u>Combat focused training issues</u>

- How can we better replicate actual combat conditions? Can the soldier be totally immersed in simulations so as to create the illusion the event is live?

- What are the differences between training devices, simulations, and actual combat systems? Are there inaccuracies? What improper lessons are being taught? How can training devices to more accurately reflect real world conditions?

- What is the proper ratio of live fire and simulated live fire training and other collective tasks?

- What techniques can trainers use to add more "surprise" in their training?

<u>Combat-Focused Training Quotes</u>

"Train like you will fight. Consider safety from the standpoint of determining how to do the training safely. Do not cancel training because you can't or won't try to figure out the safety piece."

"Don't go 'admin'. Conduct the tactical training in a realistic, immersed environment. Do it completely tactical, with integrated stressors and depth of realism down to the individual level. Don't make anything notional. That is, if the trucks don't show up, you don't have trucks. If your weapon breaks, it's broken. Deal with it. Nothing we do in training towards realism will fail to occur on a mission. Use it all."

"Leaders down to the lowest level must make the troops under them execute tasks with the 'I'm really there' mindset".

"While serving in units that trained like they were going to fight I was able to incorporate lessons learned in combat and to apply them during training. Instructors who had combat experience and were allowed to run realistic training scenarios influenced me and greatly improved my individual skills and the unit's collective combat readiness, lethality, and survivability."

"Many years in a unit which everyone knew it was not a question of "if" you'd be in combat, but "when." Training was focused on being ready for worldwide deployment in X hours."

"Train subordinate leaders to the next level up."

"Train on all aspects of the mission; never omit movement to the objective, casualties, extraction or withdrawal and contingencies."

"Finish with a tactical exercise to reinforce the training."

Visualization

Visualization was frequently mentioned as an important technique for skill mastery. The meaning of term visualization did, however, vary between some of the SMEs. In most cases it referred to the soldier having and actively cultivating an image of what was going to happen. A soldier must know what to do and how to do it, before he or she can do it correctly. Most of the SMEs saw visualization as an essential first step to mastery. Foremost, the soldier must clearly know what correct performance looks like. To accomplish this, trainers show students an expert instructor demonstration or video, or allow time to quietly visualize how a task is executed. Other related techniques include graphics or graphical depiction of success and "road mapping" the proper sequence. One SME described road mapping as… "Paint a mental picture where you are taking them!" From simplistic fundamental sub-tasks to collective rehearsals with floor plans or sand tables, visualization was described as a critical step in the learning process.

The use of video and video cameras was repeatedly suggested as a means to both demonstrate correct performance of the task and subtasks and to provide the soldiers feedback on how they performed each task and subtask. It was noted that it is often important to slow down the individual steps of a process as a means to demonstrate the proper sequence of events. As described above, visualization can be an important component of combat focused training. Visualization can also play a critical role in the TTP development process. TTP developers should visualize themselves in the combat environment and then analyze the proper courses of action.

Simulators, simulations, and modeling were seen as helpful visualization tools, at least to a certain level. Most of the SMEs felt that the simple instructor demonstrations showing the tasks executed flawlessly and quiet reflection or meditation, along with simple video applications were appropriate alternatives to expensive simulators. With that being said, it was widely recognized among those interviewed that with the increased cost of today's weapons and equipment, the Army must continue to explore the use of modeling and simulations. To be effective, the simulations must immerse the soldier in the training event and create the illusion that it is live. Simulation is viewed by many, as a supplement to live fire scenarios, not a replacement for them.

Visualization Issues

- What are ways to improve visualization as a training method and to emphasize its importance to Army trainers?

- What train-the-trainer tools are needed to help trainers use the training resources that are available to them, e.g., how to make better use video and video cameras

- How can simulations be made more realistic so as to increase their immersive qualities?

Repetition

Repetition was described as another cornerstone of high-performance training. Combined with proper visualization, subtask procedures must be memorized and drilled into the psyche and muscle memory (i.e., overlearned). This was seen as especially true for troops that frequently receive new cutting-edge, high-tech equipment. The SMEs felt that overlearning the subtasks was essential for full integration of new equipment into the unit. For rapid skill mastery, this may sometimes require further break down of complicated steps into finer subtasks so that each required step is drilled and rehearsed. It is believed that the importance of repetition cannot be overemphasized when referring to a new technology.

A complementary requirement is training soldiers how to the fully "forget" the old skills or habits, once an old system or piece of equipment is replaced with a new, similar one. New equipment often is not designed with control mechanisms or safety features in the same locations as the system it is replacing, even though many of the parts might be similar. In stressful situations soldiers tend to

revert to old techniques or procedures, because they had been drilled into their psyche. Trainers must ensure that soldiers have fully unlearned the old ways.

While rote memorization and drills are very important, they are not the whole answer. Thoughtful reflection must accompany and precede any repetitive drill session. To be most effective, repetitive training must not be a monotonous, thoughtless exercise. Many repetitive drill proponents do not fully explore the "what if" question. For example, what if weather conditions or other environmental factors change? What if ambient lighting conditions change? All possible scenarios must be reviewed and thought through before beginning repetitive drills. Troops receiving new equipment as part of the technological transformation to the Objective Force must reflect on the "what if" questions as each new technology arrives.

Repetition combined with visualization of possible contingencies allows high-risk professionals to mentally rehearse scenarios they might encounter. The more thoughtful the reflection applied prior to the repetitive drill, the higher the likelihood of success. Improperly timed hesitation or decision gaps in dangerous high-risk professions can be deadly. Typically this hesitation manifests itself in situations brought on by surprise events (i.e., events foreseen or not previously drilled).

Training Repetition Issues.

- What are the most effective training techniques for quickly unlearning old habits or skills and quickly learning new, similar ones?

- Are there negative effects of high levels of repetition training (e.g., does it reduce hesitation at inappropriate times)? If so, how are these negative effects minimized?

- What training technologies are needed to create environments appropriate for effective repetition of new Objective Force tasks?

- What are the best approaches for combining visualization, mental rehearsal, and repetition?

Technology Aids

Technology aids must be considered from two perspectives. First, there are new equipment technologies that the Army is fielding and second, there are training technologies. New equipment technologies must enhance the soldier's lethality, mobility, survivability, and situational awareness. Training technologies must enhance the learning and retention of motor

skills, cognitive skills, and psychomotor skills. When applied to training specific tasks or equipment, this technology must enhance soldier potential with increased skill retention and increased task performance.

The desired end state is to simulate realistic events in which the soldier is totally immersed in the event in a controlled learning environment. This environment enables the soldier to gain experience and confidence in his or her capabilities prior to execution of the task in combat. The SMEs were questioned at length about training technology aids. The common theme was that the more realistic and lifelike the simulated training experiences were to the actual anticipated event, the more effective the training and the greater the retention of the skills. It was firmly believed that soldiers retain skill sets better and longer when learned and then practiced under realistic, stress-induced situations. Most of the training devices discussed revolved around shooting skills. Because of the overwhelming importance of lethality and survivability, most of the SMEs felt that marksmanship training, especially live-fire training, should take priority over any other training.

The video camera was identified as the most appropriate and versatile of all the training devices found. Its use ranged from visualization to AARs to documentation, and information gathering information during combat operations. The relatively low cost made it affordable to all units, even private individuals. The professional shooting instructors, drivers training, and martial arts instructors all use video to demonstrate proper techniques, sell their products, and document their competitions for AARs.

Training technologies, in and of themselves, were not seen as the answer to training soldiers for combat. When employing training technologies, trainers must determine the impact of the technology on the training event. To be effective, the soldier must be immersed in the event and believe that "this is really happening to me." There has been much emphasis placed of late on the use of embedded training. For example, embedded training is seen as the centerpiece of Object Force training. Whether embedded training can truly be made cost-effective for the majority of future systems is yet to be seen. Effective training technologies must reduce the time required to train the task and/or increase retention of critical combat skills that result in increased mobility, lethality, and survivability of soldiers.

Training Technology Issues

- How can trainers create more stressful training with training technologies?

- What attributes are needed in training environments so that soldiers feel "they are really there?" How can these attributes be represented in training environments in a cost-effective way?

- How can trainers be trained to use video cameras more effectively in their training?

- Can embedded training be made cost-effective? What training methods are needed to support embedded training capabilities?

SOF Training Techniques

Given the SMEs' extensive SOF experience, they were ask to describe effective SOF training techniques in a number of specialty areas that are of particular applicability to OFW. In general, they described three methods for delivering instruction: lecture, demonstrations, and hands-on performance-oriented training. Clearly hands-on, performance-oriented training (POT) was the preferred method of military training.

Weapons

As the Army transforms, weapons proficiency remains of paramount importance. Proficiency with the weapons in the Army inventory, as well as a multitude of foreign weapons that proliferate the modern battlefield, is required.

SOF units hired professional shooting instructors to hone the skills of the Special Operations soldiers to a razors edge. The instruction focused not only on the correct form, but also the characteristics of the bullet, high-angle shooting, shooting through obstacles such as glass and lightly skinned vehicles, and the use of silencers and flash suppressors. For example, one SME related that during an instructional pistol marksmanship class, the students spent half an hour just on moving the shooting hand to the pistol grip. Each step in the process, from drawing the weapon to firing at a target, was broken down and repeated hundreds of times before a shot was ever fired. This instilled "muscle memory" into the students and drawing the weapon became secondary. These professional instructors brought an élan to SOF as they refined the abilities of the soldiers.

The professional shooting instructors, in many cases, were former members of the unit that had completed a successful career in the military and had started a second career. The skills obtained while serving transitioned nicely into their second career. The SMEs suggested that the Army take a hard look at having a professional instructor corps within its ranks to conduct training. In the time of down sizing, it may be more important than ever to hire highly effective, high performing training specialists.

Based on their combat experience and numerous training courses, senior NCOs are going to be the primary instructors for daily weapons training. The focus should be on drilling the basics and sharing the advanced, special "tricks of the trade" to further younger soldiers' operational capabilities. No professional instruction courses are conducted without the NCO In-Charge's (NCOIC) approval of the program and its safety measures.

Special Operations soldiers are famous for employing their weapons in unconventional roles. This freethinking, non-standard application of weapons and weapons systems is permissible because of the standards of the unit and the professionalism of the soldiers. This allows SOF teams to accomplish tasks that normally require platoon or larger units of the conventional force.

Breaching

Professional breachers (i.e., experts in the use of conventional explosives) taught the Special Operations soldiers the art of breaching obstacles. The instruction focused on the chemistry of explosives, shock and detonation waves, initiators and initiation of charges, and blast calculations. Providing expert classes in blast prediction, blast overpressure and blast wave propagation allows soldiers to determine and construct the precise charge required for the mission. Advanced skill levels reduce the standoff required for charges to an absolute minimum,

thus allowing faster accomplishment of the mission. By increasing the scope of the breaching instruction to include not only the art, but the science of explosives, it enables the soldiers to accomplish their breaching tasks with minimal danger to themselves, others, and the surrounding environment.

Fire Control

Fire Control was trained concurrently with Air Force Combat Control Teams. This certification process provided the Air Force, Marine Corps, and Navy aircraft the required confidence that enabled the soldiers to provide terminal guidance to fast movers (i.e., jet aircraft) for close air ground support. This training approach enabled the soldiers to understand how the joint services think and act during mission support. Additionally, the soldiers learned exactly what information aviators required before they would release their ordinance. Furthermore, training with the equipment enabled a call for fire mission to become second nature for soldiers.

As an example, prior to departure for Operation Desert Storm, soldiers spent three days at the National Training Center (NTC) training with Air Force and Marine aviators. Two months later after coming in contact with eleven Iraqi armored personnel carriers (APCs), the soldiers called for a fire mission using Air Force jets in support of ground operations. As a result the targets were engaged and killed and there were no communication problems between ground or air forces. Soldiers and aviators had far greater confidence as a result of this approach to training. The aviators were confident in the ability of the soldiers to control calls for fire, and the soldiers were confident in the aviators' ability to deliver precision fire support.

Combat Life Saving

Medical training for Combat Life Savers was conducted at local medical facilities. Trauma medicine is best learned in a controlled environment, with sufficient professional staff available to enable the student the opportunity to learn. Advanced Trauma Life Support (ATLS) and Advanced Cardiac Life Support (ACLS) classes were scheduled and conducted in concert with the Academy of Health Sciences. Additionally, local community colleges were contracted to provide Emergency Medical Technician (EMT) and Paramedic certification for soldiers. This not only increases their potential as soldiers on the battlefield, but it enhances their resume for employment upon retirement, an additional, personal incentive to learn the skills.

As an example, during a helicopter crash in a combat zone, the triage and care of mass casualties was conducted by all available soldiers. A Special Forces medic provided oversight with the result being no loss of life or limb. This was a serious case where 12 officers and NCOs had broken bones, four had broken backs, and one had a concussion. Surgeons lauded the team attending the injured. This care was given in the field under austere conditions at the crash site. Training on the proper procedures, such as primary and secondary surveys, splinting, starting intravenous fluids (IV's) and triage was standard in day-to-day live-fire exercises. When the actual situation occurred, the teams dealt with it calmly and quickly.

Mobility

Defensive driving and off-road operations is another area that the SOF received additional training. Due to the possibility of assignment as bodyguards, soldiers received specialized training in high speed driving and defensive driving techniques at institutions such as the Atlanta Motor Speedway and Bondurant School of High Performance Driving in Las Vegas. Additionally, soldiers received training in off-road operations. This training enabled the soldiers to traverse various terrain under adverse conditions and allowed them to approach their target from an unsuspected direction of attack.

Recent combat operations in Iraq pointed out the importance of this type of training. A Special Forces Team (+) encountered a battalion of Iraqi Infantry in a small town. They drove through that town twice, while calling for fire from close air support (CAS). The results of this contact were numerous enemy killed with no U.S. casualties. The driving training that they had received prior to this directly contributed to their success and enabled them to drive damaged HMMWVs and pickups through the melee of fire without loss.

Operations and Intelligence

Operations and intelligence skills were taught using the CARVER-C (Criticality; Accessibility; Recuperability; Vulnerability; Effect; Recognizability; and Collateral damage) System. This training significantly increased the lethality of the individual and the small unit. It allowed the soldiers to provide appropriate information to the Common Relevant Operating Picture (CROP), which enabled higher headquarters to act first and decisively. The SMEs thought that operations and intelligence training could perhaps be the most important training needed for the Objective Force soldier. The ability for the soldier to understand the asymmetric enemy, read imagery, analyze a target, and predict target weaknesses and vulnerability are the keys to "Understand First."

Summary

There were several key SOF training techniques that were common across all of the specialty areas. They consistently used highly competent instructors; in many cases these were professional trainers. They trained the basics first and then expanded to the "art." They learned the theory behind what they were doing, which gave them the knowledge to adapt to different and changing situations. They trained with others with whom they would be fighting. And lastly, they trained a lot.

High-Risk/High-Performance Trainers and SMEs

As part of this project, we identified and interviewed a number of individuals that continue to associate with training high-risk, high-performing individuals in military related tasks. This includes individuals who train world-class survival skills, martial arts, security operations, and competition shooting. Appendix B provides a partial list of trainers that Army training developers and the OFW program can consult regarding the design and implementation of future

training technologies and to aid the development of rapid, technologically-advanced training concepts and equipment. These high-risk training SMEs were chosen for their innovative training concepts and in many cases, for their demonstrated combat experience. Many have come with extremely high recommendations from Special Forces and SOF. For reasons of privacy we have only listed their initials, but can provide names and additional information to interested, appropriate parties.

Training Technology Vendors

Another of this project's purposes was to identify vendors who are currently producing military-related training technologies. This information should be of use to both Army training developers and the OFW Lead Technology Integrator and Technology Program Office. The results of that market survey are included as Appendix B. The primary sources we used to find these vendors were the SME interviews and leads from the Interservice/Industry, Training, Simulation, and Education Conference (I/ITSEC). I/ITSEC is a large training conference and trade show held each year in Orlando, FL the first week in December. For additional information check their website at www.iitsec.org.

We have categorized training vendors into five functional categories of training support: sustainability, mobility, survivability, lethality, and situational awareness. In many cases, vendors could have been included in multiple categories, but was done sparingly. For each vendor, we include a training technology category, vendor and/or trade name, phone number, address, and web address. Inclusion in this list should in no way be construed as an endorsement.

Conclusions

The goals set out for the Objective Force are rather daunting. Compared to our current force, the Objective Force is to be more strategically responsive and dominant at every point on the spectrum of military operations. It is to be more deployable, more agile, more versatile, more lethal, more survivable, and more sustainable (U.S. Department of the Army, 2001). Clearly this will involve the fielding of many new systems with advanced materiel-based capabilities. But new weapons and command, control, communications, intelligence, surveillance, and reconnaissance (C4ISR) systems are not sufficient. There must also be a culture shift to include a synthesis of the best from the conventional and SOF forces. Furthermore, there must be new training and leader development methods and technologies to support the new systems and the new Objective Force culture. This project provides a small step toward that synthesis.

It is clear from the interviews with SOF SMEs that there is no silver bullet that is going to quickly revolutionize the training of Objective Force soldiers. Fundamentally the ability of an individual to learn is dependent upon the persons' aptitude, attitude, and motivation. The soldier must have the desire to learn the task and the training must be challenging and relevant to the mission. Effective training, be it classroom, simulation-based, or hands-on, stimulates a soldier's desire to learn and, indeed, to become a subject matter expert. The method of training is not as important as the quality of training, which is a combination of the material being presented, the

method in which it is presented, and the motivation of the trainer and the trainee. Another, perhaps equally important factor is the amount of training. One of the primary reasons that SOF units demonstrate such high levels of performance is that they train more, with relatively unlimited training resources as compared to conventional units.

If the Army is serious in transforming training, it must make the conscious decision to assign top quality personnel to instructor billets based upon their demonstrated ability to train, not simply upon PCS eligibility, as is the current process. Success as an instructor should be considered an indicator of potential for increased responsibility and promotion. The Army must rebuild the professional corps of instructors for all proponents, or it will be relegated to hiring SMEs to conduct the training. Furthermore, the Army should seriously examine the tradeoff between buying new expensive systems and resources for training. The sustained superior performance of SOF forces may be less a function of their equipment, and more a function of repetitive, combat-focused, live-fire training.

Time management, command of the basics, skill mastery, combat focus, visualization, emphasis on appropriate repetition, and the use of simple aids predominated the thinking of the vast majority of respondents. Clearly these are not new concepts, but they are critical. In fact, many of the issues identified in this report echo the training lessons learned from the fielding of the first digital division and the Stryker Brigade Combat Teams (Johnston, Leibrecht, Holder, Coffey, and Quinkert, 2002). As the Army continues to transform to a more deployable, agile, and lethal force, we must remember that high-performance is rooted in being able to perform basic tasks quickly and accurately, and not just in having the latest high-tech equipment.

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Appendix A

Training Technologies and Procedures Questionnaire

As mentioned in previous conversations and the attached letter, this questionnaire is intended to collect your thought about current and future training technologies and procedures. The results of your questionnaire will be collated with those of other SMEs. Most of the SMEs are senior NCOs with experience in SOF, or civilian/law enforcement high risk training experts. As the list grows there might more input from law enforcement and emergency services personnel. Analysis of the results will help to focus training strategies for the future. The scientists in the Army Research Institute hope to gain insights into new technologies and techniques based on acknowledged expert advice. Focus on efficiency in training is paramount. The Army usually seeks out world-renown SMEs trainers and advisors in times of national emergency, to help focus and refine training. This is especially important now for several reasons:

> *Our nation is at war, an unconventional war.*
> *The Army is undergoing a DOD-mandated transformation.*
> *New technological advances directly impact on available training time.*
> *Technological advances must come with direct applications, not for advancement of a technology for its sake...but for the added combat value to the team.*

In an effort to gather as much information as possible, we have listed a menu of topics and subjects as prompters that you might address. Please describe how you would train individuals, or a team for high-risk missions, including best technologies, techniques, procedures, tactics, or instructor philosophy. Please give references to books, videos, articles, publications (yours or others) or any other studies that might be of interest. Please recommend other experts, authors or authorities in the subject area of training high-risk, high-performing teams, individuals, and leaders for intensive fast paced operations.

1. Please describe your core training philosophy.

2. How did you develop your core training philosophy? Was it an instructor's technique, a life-changing training or real-world event, or an item of training technology?

3. How important is visualization to skill mastery?

Not important   Very important

-4	-3	-2	-1	+1	+2	+3	+4

Discuss technologies, techniques or guidelines for improving visualization.

4. How important is repetition to skill mastery?

Not important   Very important

| -4 | -3 | -2 | -1 | +1 | +2 | +3 | +4 |

Please give your views on repetition.

5. Describe your most memorable technological aid to training.

Please suggest an example technology to accelerate learning or retain task proficiency? (Please include actual manufacturer information, if known).

_____
_____
_____
_____
_____
_____

6. Please describe the traits of your most memorable successful (best) instructor.

7. Please describe the traits of your most memorable unsuccessful (worst) instructor.

8. Please suggest ways to accelerate the learning curve.

9. When students don't "get it" what do you suggest?

10. When competing or executing high-risk or combat tasks, how do you focus on the task and block distracters?

11. The remaining list of questions can be viewed as prompters, feel free to address them as time permits.

- How do you refocus for a new skill?
- Describe (in percentages) a suggested breakdown for platform, hands on, media viewing, or visualization to teaching a skill.
- Suggest ways to accelerate the learning curve.
- How do you de-mystify a task?
- Please give examples of firms or technological training tools in your field of expertise that you would suggest for improving troop training.
- What is a student's main block or obstacle to learning...how do you suggest alleviating the above block?
- Is repetition more important than a training review or AAR?
- How should reviews or AAR's work to get accelerated learning?
- Describe the proper procedure you use for review, retrain, review.
- How important is student to instructor interaction or discussion Q & A?
- Describe your best technology enlightening moment, "light bulb factor".
- Is there a direct relationship between total failure and absolute success...a breakthrough moment?
- Is it true that students learn more from their failures than successes?
- How important is job satisfaction or enjoyment of the task?
- How does boredom affect learning?
- How is boredom countered?
- How important is pushing a student past their comfort level?
- How can we accelerate this process?
- How does one maintain focus to accomplish missions under distracting conditions?
- How do we train troops to do this?
- What technologies and techniques will enable a rapid learning curve in the future?
- How is task prioritization done?
- Is there a common thread between high risk civilian, emergency personnel or law enforcement and military tasks?

12. Please provide us your thoughts on the following training topics:

- Rapid learning curve
- Efficient learning
- Effective learning
- Retention of learned tasks
- Re-focus for METL, or new battle tasks
- Re-focus training for Contingency Operations
- Rehearse for specific missions or identified objectives

- Increase realism (stress)
- Increase effectiveness and efficiency
- Training under stress
- Train in high risk or potentially fatal situations
- Raise combat effectiveness values (CEV)…raise and measure
- Combat "focused" training (if you wouldn't do it in combat…don't do it in training)
- Doctrine immaterial training
- Repeatable and measurable training
- Multi-task training
- Improved training
- Exciting! training
- Dangerous! training
- Exceeding levels of comfort training
- Pushing the envelope
- Exhaustive training, training when tired or fatigued
- Physically difficult training
- Physically painful training
- Unconventional training
- Common sense training
- Opportunity training (hip pocket)
- Task/subtask oriented training
- Refresher training
- Challenging training

Appendix B

High Risk/High Performance Training Subject Matter Experts

1. "MG". SGM (R). Vietnam veteran with extensive experience in Special Forces (SF). Served in the Studies and Observations Group (SOG) where he performed the earliest High Altitude Low Opening (HALO) infiltrations into combat (Vietnam). He was the most demanding and high performing instructor of HALO, recon, and Close Quarter Battle drills. He demands extra measure from his troops, always leading by example. He led numerous extremely high-risk combat operations as a senior NCO. Many of these operations were singleton in nature requiring only one or two NCOs in country. Continued service with SOF until retirement in the mid-90's. Now serves a registered nurse and can give insight into high-risk medical emergency situations as well. He can train troops on all aspects of infiltration, close combat, medical emergencies. Using nothing but his personal experience or high tech training devices.

2. "TB". Has authored 10-12 books on survival, tracking, and nature awareness. As the primary instructor in his on-going courses he typically trains 100-125 students in one-week blocks. Recognized worldwide for his common sense back-to-prehistoric-basics. Situational awareness is the cornerstone of his instruction. He understands and teaches the "WHY and HOW" of situational awareness and the effect of its loss. He trains city dwellers to rapidly transition from the close vision of computer screens and TV's to wide-angle vision of the natural woodlands, quickly regaining situational awareness. Training everyone to "track" includes looking at all surroundings and understanding why a limb was broken during a storm 5 years before, or 5 minutes before. He understands and teaches ALL pre-historic weapons and is well versed in the Martial Arts. Can defeat modern sensors of all types, expert in camouflage, and weapons that can by-pass metal detectors. This course has spun-off numerous other survival courses that are run by his former assistant instructors. He can teach all troops basic survival skills. Fully understands human factors and the how, why, and when of switching from technology to basic survival instincts.

3. "PK". Retired FBI agent and former member of Navy SEALs with multiple Vietnam tours. He currently works as private investigator and shooting instructor. Extremely well fit, doing difficult SOF obstacle courses into his 50's. Hundreds of high-risk arrests, primary shooting instructor for FBI SWAT in various field offices. Joined the search for Eric Rudolf and led many patrols into the NC mountains in the search for this elusive character. Conducted numerous overseas assignments in high-risk hostile fire zones.

4. "DD". Expert tracker. Author of a tactical combat tracking course. Former officer and member of the Rhodesian SAS. Tracked hundreds of terrorists. Excellent instructor of high-risk, difficult tasks. Excellent tactical guide for the development and employment of tracking teams and their interaction with follow on forces. Currently teaches Special Forces Groups, the Ranger Regiment, FBI, Border Patrol and numerous other state and federal agencies. World re-known expert in combat tracking.

5. "JB" . Excellent shooting instructor. Three-time national champion in International Pistol Shooting Competition (IPSC). World re-known trainer in 3-gun (pistol, M-4 and shotgun) disciplines. Excellent instructor of Special Forces and the Ranger Regiment. Uses any technological edge, in training to capture the smoothest way to target engagement. Trains SWAT law enforcement teams from around the country.

6. "MV". Two-time national Champion in 3-Gun Competition. National Sniper Competition Champion. Excellent instructor of sniper weapons, tactics and engagements. Uses the latest gas operated magazine fed (20 round) weapons to defeat the competition. Train SF and SWAT law enforcement teams from around the country. Standing supported engagements of 19" x 10" targets at 400 meters are commonplace for this shooter. Sitting engagements out to 700 meters, done with ease, multiple targets, rapid transition are his specialty.

7. "JS". SGM (R). Former Golden Knight, SF, Ranger, Sniper, and Recon. Two-time World Champion Style and Accuracy parachuting in the mid 80's. Combat veteran of Just Cause and Desert Storm. Competitor in European international Combat Team Competition (1991) on the first US first place team, key member in setting GSG-9 obstacle course record. Advanced Freefall (AFF) parachuting instructor with over 5000 logged jumps. Wrote the book on training high risk, difficult tasks. Uses any technological edge possible to train his troops.

8. "DM". Retired Army Surgeon. Former Special Forces Medic. Highly Decorated Combat Surgeon. Medically retired for wounds received in combat. Developed and maintained the highest priority SOF medical staff and surgical team. Trained dozens of Special Forces medics, PA's and Army Nurses on the "How to" of combat medicine. He knows and can give references to many other high-risk medical teams in the US. Well versed in the use of technologically advanced medical training equipment. Always pushed his charges (SF medics) to increase and maintain their medical skills.

9. "RH". Professional Off-Road Baja Racer. Three time winner of the Baja races. Owns and runs a stable of HMMWVs in Nevada. His two sons and numerous instructors form a cadre of the best off-road racers in the world. They use every high tech and training device available and equip their vehicles with to win. Offer non-stop racing and instructional courses to train and perfect off-road navigation and driving skills. Training also delivered by retired SOF SGM serving as tactical and technical advisor. Best in the country at high risk driving.

10. "BS". Professional Racer and Instructor. Course specializes in on road high-speed maneuvers and ambush avoidance. Course includes night vision driving, counter-ambush live fire, take-out maneuvers are the norm. This instructor and his assistants constantly upgrade their technological training devices to provide top-notch instruction. Maintains many former Special Forces Instructors for SMEs in live fire counter ambush lanes.

11. "TW" MSG (R). Ranger Instructor, Climbing Instructor, Mountain Ranger Camp. Served with SOF and Rangers on combat tours. Two-time winner of Best Ranger competition. Currently training high-risk law enforcement teams in close quarter engagements. Recognized with the Soldiers Medal for life saving in alpine setting, numerous alpine rescues as a member of

the Mountain Ranger Camp and mountainous area volunteer fire department. Trained hundreds of Rangers in basic and advanced mountaineering skills.

12. "JG, JG". Jujitsu Champions. World Ultimate Fighting Champions. Three generation family of Jujitsu instructors who have won many major international major martial arts competitions. Constantly update training courses with technological advances (mainly video). Have trained many SWAT law enforcement teams, and elite military organizations in physical restraints and close combatives.

13. "TM". SGM (R). Chief martial arts/combatives and tactics instructor for national level Diplomatic Service (DS) agents. His instruction includes close combat engagements and weapons disarming techniques. Combat veteran with multiple tours, including many SOF combat missions. Teaches unique form of martial arts that is very closely related to soldier combat tasks. Maintains close relationships with DS agents to insure proper alignment of instruction to their specific area or requirements.

14. "AG" SGM(R), Sheriff's Deputy, Chief advisor and trainer to area SWAT Law Enforcement. Currently heads training programs for several area SWAT teams. Martial Arts instructor, combat veteran of numerous combat zones and hostile fire zones. Developed several combatives training programs for SOF Instructs personal security teams nationwide.

Appendix C - Training Technology Vendors

The following vendors provide related military training technologies that might be tailored for OFW training.

Sustainability

TECHNOLOGY CATEGORY	VENDOR'S NAME/"TRADE NAME"	PHONE	ADDRESS	WEB
Log planning simulations	Applied Research Association Inc (ARA)	(505) 881-8074	4300 San Mateo Blvd NE, Suite A220, Albuquerque, NM 87110	www.ara.com
Maintenance training and simulations	Arinc	(410) 226-4000	2551 Riva Road, Annapolis, MD 21401	www.arinc.com
Maintenance training and log planning sims	Blackhawk Management Corps	(281) 286-5751	1335 Regents Park Drive, Suite 301 Houston, TX 77058	www.blackhawkmanagement.com
Equipment operations training and sims	Global Info Systems Tech INC	(217) 352-1165	100 Trade Centre Drive, Suite 301, Champaign, IL 61820	www.gistrinc.com
Acquisition and log planning training and sims	Information Spectrum, INC	(703) 354-3737	7611 Little River Turnpike Suite 200E Annandale, VA 22003	www.spec.com
Parts planning and Maintenance training and sims	L-3 Communications, EER Systems	(703) 375-6500	3750 Centerview Drive Chantilly, VA 20151	www.eer.com
Log and supply planning and training and sims	TEC Master, INC	(256) 830-4000	1500 Perimeter Parkway Suite 215 Huntsville, AL 35806	www.tecmaster.com
Maintenance training and log planning sims	TSM Corp	(901) 373-0300	5705 Stage Road Suite 240 Bartlet, TN 38134	www.tsm.pss.com
Maintenance training and sims	AEROsim-Mechtronix	(952) 894-4694	12281 Nicollet Ave , Burnsville, MN 55337	www.aerosim.com
Maintenance training and sims	Cybelius Software	(408) 286-1600	4 N Second St Suite 560,San Jose, CA 95113	www.cybelius.com

Mobility

TECHNOLOGY CATEGORY	VENDOR'S NAME/ "TRADE NAME"	PHONE	ADDRESS	WEB
Flight simulators	Frasca International, Inc.	(217) 344-9200	906 East Airport Road, Urbana, IL 61802-7407	www.frasca.com
Flight imulators	FlightSafety International	(314) 551-8400	5695 Campus Parkway, St. Louis, MO 63042-2338	www.flightsafety.com
Vehicle driving simulators	FAAC, Inc.	(734) 761-5863	1229 Oak Valley Drive, Ann Arbor, MI 48108	www.faac.com
Modeling, simulations. HFE, and user interface design	The HFE Group	(613) 230-8226	220 Laurier Ave. W., Suite 350 Ottawa, Ontario K1P 5Z9 Canada	www.thehfegroup.com
Imagery management and delivery systems	ImageLinks, Inc.	(321) 253-0011	4450 W. Eau Gallie Boulevard Suite 164, Melbourne, FL 32934	www.Imagelinks.com
Mission/flight/weapons systems simulators	Indra	34-91-626-8600	c/Mar Egeo, 4-Pol. Industrial n 1, San Fernando de Henares, Madrid, 28830 Spain	www.indra.es
Training products, services, training system support	Information Spectrum, Inc.	(703) 354-3737	7611 Little River Turnpike, 300E, Annadale, VA 22003	www.ispec.com
Live training equipment	Inter-Coastal Electronics	(480) 981-6898	5750 East McKellips Road Bld 100, Mesa, AZ 85215	www.inter-coastal.net
Display devices for military simulations.	Interface Displays & Controls, Inc.	(760) 945-0230	4630 North Ave., Oceanside, CA 92056	www.interfacedisplays.com
Advanced air combat maneuvering Instrumentation	Israel Aircraft Industries	(703) 875-3728	1700 North Moore Street, St. 1210, Arlington, VA 22209	www.iai.co.il
Training and simulations	J. F. Taylor, Inc.	301-862-3939	21610 South Essex Drive, Lexington park, MD 20653	www.jfti.com

Real-time microprocessor-based control systems	Micro Systems, Inc.	(850) 244-2332	35 Hill Ave., Fort Walton Beach, FL 32548-3858	www.gomicrosystems.com
End-to-end solutions for training	Lockheed Martin Corporation	(407) 306-6861	12506 Lake Underhill Road, Orlando, FL 32825	www.lockheedmartin.com
Digital comms training for combat vehicles	Oasis Advanced Engineering	(248) 373-9800	3200 Cross Creek Parkway, Auburn Hills, MI 48326	www.OasisAdvancedEngineering.com
Flight simulators	OPINICUS Corporation	(727) 799-4558	28870 US Hwy 19 N, Suite #400, Clearwater, FL 33761	
Lighting products for aircraft cockpits	Paramount Panels, Inc.	(909) 947-8008	1531 E. Cedar Street, Ontario, CA 91761	
Modeling and simulation	PLEXSYS Interface Products, Inc.	(503) 251-0455	P.O.Box 301459, Portland, OR 97294-9459	www.plexsysipi.com
PC-based IG for training & sims	Primary Image	(407) 540-1252	4370 LB McLeod Road, Orlando, FL 32811	www.primary-image.com
Situational awareness & management	Secure Asset Reporting Services	(907) 777-5500	7941 Sandlewood Pl, Anchorage, AK 99507	www.sarsinc.com
CRT and flat panel visual displays	SGB Enterprises, Inc.	(661) 294-8306	25327 Ave. Standord Unit 101, Valencia, CA 91355	www.sgbent.com
Simulation technologies	STN ATLAS Elektronik GmbH	49-421-457-4199	Sebaldsbruecker Heerstr. 235, Bremen, D 28395 GERMANY	www.stn-atlas.de
3D scene & object digitizing	3rd Tech, Inc.	(919) 929-1903	119 E. Franklin St. 3rd Fl, Chapel Hill, NC 27514	www.3rdtech.com
Projection/HUD and CRT applications	Thomas Electronics, Incorporated	(973) 696-5200	100Riverview Drive, Wayne, NJ 07470	www.thomaselectronics.com

Survivability

TECHNOLOGY CATEGORY	VENDOR'S NAME/"TRADE NAME"	PHONE	ADDRESS	WEB
Medical simulations	General Dynamics/"GDAIS"	(480) 777-1700	1805 West Drake Dr, Tempe, AZ 85283	www.gd-ais.com
Medical simulations	Hewlett-Packard Co/"Public Sector Organ"	(443) 285-4043	8890 McGaw Rd, Columbia, MD 21045	www.hp.com/go/publicsector
Medical sensors	Intersense,Inc	(781) 270-0090	1 North Ave, Burlington, MA	www.isense.com
Environmental survival	ISERA Group LLC	(809) 963-5200	135 East Ortega St, Santa Barbara, CA 93101	www.isera.com
Medical training	Kaiser Electro-Optics, Inc./"Proview HMD"	(760) 438-9255	2752 Loker Ave West, Carlsbad, CA 92008	www.keo.com
Medical engineering	Karta Tech, Inc.	(210) 582-3000	5555 NW Parkway, San Antonio, TX 78249	www.karta.com
Cover and concealment	MDG Fog Generators Ltd/"Pro Modular fog Systems"	(514) 272-6040	5639 Chris-Colomb Montreal,Quebec H2S 2E8 Canada	www.mdgfog.com
Medical sims and visualization	Meta VR	(617) 739-2667	37 ELM St, Brookline, MA 02445-6813	www.metaVR.com
Customized medical products and displays	Multichip Assembly,Inc	(408) 271-2740	1598 Monterey rd San Jose, CA 95110	www.multichipassy.com
Force protection training	Ontar Corp.	(978) 689-9622	9 Village Way North Andover, MA 01845-2000	www.ontar.com
Medical training and simulations	Plateau	(703) 292-0200	671 N Glebe Rd Suite 700,Arlington,VA 22203	www.platea.com
Heads up displays	Polhemus Inc	(802) 655-3159	40 HERCULES Dr PO Box 560, Colchester, VT 05446	www.polhemus.com
Battlefield medical training	Rafael	(972) 879-5232	PO BOX 2250 (80), Haifa, 31021 ISRAEL	www.rafael.com

Medical technology simulations	RTI International	(919) 541-6000	3040 Cornwallis Rd Research Triangle Park, NC 27709	www.rti.com
Medical visual effects	SGI	(650) 933-1980	1600 Amphitheater Parkway Mt View CA 94043	www.sgi.com
Medical training and simulations	Stottler Henke Association, Inc	(650) 655-7242	1660 S Amphlett Blvd, STE 350, San Mateo, CA 94402	www.stottlerhenke.com
Medical training and simulations	Ternion Corp	(256) 881-9933	3325 Triana Blvd, Huntsville, Al 35805	www.ternion.com
Risk reduction & Force protection training and sims	Advanced Systems Technology, Inc.	(888) 248-0321	4111 West Gore Blvd Lawton, OK 73505	www.astcorp.com
Telemedicine training and sims	Applied Global Tech, Inc.	(321) 638-2007	5575 South US 1 Rockledge, FL 32955	www.appliedglobal.com
Risk reduction and force protection training and sims	Applied Research Association, Inc.	(505) 881-8074	4300 San Mateo Blvd NE Suite A220 Albuquerque, NM 87110	www.ara.com
Night vision optics training	DCS Corp	(703) 683-8430	1330 Braddock Place Alexandria, VA 22314	www.dcstrainingsupport.com
Virtual and constructive simulations	L-3 Communications, Coleman Research Corp./"FORCES", "TSIU," "ETSIU"	(407) 365-1760	1912 Westbourne Dr Orlando, FL 32765	www.crc.com
Thermal optic training and simulations	Indigo Systems Corp	(805) 964-9797	5385 Hollister Ave Suite 103 Santa Barbara, CA 93111	www.indigosystems.com

Lethality

TECHNOLOGY CATEGORY	VENDOR'S NAME/"TRADE NAME"	PHONE	ADDRESS	WEB
Small arms training and sims	Air Munitions/"Air Cartridge"	(678) 969-0952	7001 Peachtree Industry Blvd, suite 116, Norcross, GA 30092	www.airmunitions.com
Small arms & preplanned fires training and sims	Applied Research Association, INC	505-881-8074	4300 San Mateo Blvd NE Suite A220, Albuquerque, NM 87110	www.ara.com
Indirect fires and ADA training, planning and sims	COEL	49 4103 93950	Rosegarten 10 Wedel, Schleswig Holstien,22880, Germany	www.coel.de
Ground and air engagement training, planning and sims	Cubic Defense System, INC/"DSTAR"	(858) 277-6780	9333 Balboa Ave, San Diego, CA 92123	www.cubic.com
Tank gunners training sims & MILES sims	Diel Luftfahrt Elektronik, GmbH (DELE)	49911957-2843	Fischbachstrasse 16-20, Roethenbach/Pegn, 90552, Germany	www.diehl.com
Small arms training and simulations	ECC International Corp.	(407) 859-7410	2001 West Oak Ridge Road ,Orlando, FL 32809-3803	www.eccic.com
SOF, snipers, tank and arty gunners training and sims	Elbit Systems, LTD	(972) 4831-5072	PO Box 539 Advanced Tech Center Haifa, 31053, Israel	www.elbit.com
Small arms, arty/ tank Gunners and air engagements	FATS, INC	(800) 813-9046	7340 McGinnis Ferry Road, Suwanee, GA 30024	www.fatsinc.com
Dismounted warfare	Advanced Interactive Systems	(800) 441-4487	565 Andover Park W Suite 201, Seattle, WA 98188-3321	www.ais-sim.com
Area weapons simulations	C.O.E.L.	(+) 49 4103 93 95 0	Entwicklungsgesellschaft mbH Rosengarten 10, WEDEL, D-2288-Germany	www.coel.de

Embedded training (vehicles)	Oasis Advanced Engineering	(248) 373-9800	3200 Cross Crfeek Parkway, Auburn Hills, MI 48326	www.OasisAdvancedEngineering.com
Gunnery and tactical training simulation	RAFAEL	972-4-8795232	P.O. Box 2250 (80), Haifa, 31021, Israel	www.rafael/co.il
Gunnery and tactical training simulation	Raydon Corporation	(386) 267-2936	210 Fentress Blvd, Daytona Beach, FL 32114	www.raydon.com
Simulation systems	Raytheon	(508) 490-2424	1001 Boston Post Road M/S 1-2-1734, Marlborough, MA 01752	www.raytheon.com
Full mission howitzer crew trainer	RUAG Electronics	(+)41 313 247 455	Stauffacherstrasse 65, CH-3000 Bern, 22 BE Switzerland	www.ruag.com
Direct fire weapons simulators	Saab Training Systems	(+)46 36 38 800 00	SE 561 85 Huskvarna, Huskvarna, SE 56185 Sweden	www.saabtrainingsystems.com
Advanced MILES	Schwartz Electro-Optics, Inc	(407) 298-1802	8337 SouthPark Circle, Orlando FL 32819	www.seo.com
Physical and cognitive behavior simulations	Ternion Corporation	(256) 881-9933	3325 Triana Blvd, Huntsville, AL 35805	www.ternion.com
Simulation and training	Thales Training & Simulation	(918) 461-1999	5233-A, South 122nd East Avenue, Tulsa, OK 74146-6001	www.thales-tts.com
Immersive Virtual Reality	VirTra Systems, Inc.	(817) 261-4269	440 North Center, Arlington, TX 76011	www.virtrasystems.com

Situation Awareness

TECHNOLOGY CATEGORY	VENDOR NAME/"TRADE NAME"	PHONE	ADDRESS	WEB
Commanders and staff	Advanced Simulations Technology	(703) 471-2104	441-a Carlisle Dr Herndon, VA 20170	www.asti-usa.com
Commanders and staff	Anteon Corp	(828) 648-1482	635 Senoma Rd Waynesville, NC 28786	www.anteon.com
Commanders and staff	Applied Research Associates	(505) 881-8074	4300 San Mateo Blvd NE Suitea-220 Albuquerque, NM 87110	www.ara.com
Information mgt & processing training and sims	Blackhawk Management Corp	(281) 286-5751	1335 regents Park Dr Suite 130 Houston, TX 77058	www.blackhawkmanagement.com
Commanders and staff	Dynamics Research Corp	(978) 475-9090	60 Frontage Road Andover, MD 01810	www.drc.com
Information mgt & processing training and sims	DynCorp	(407) 273-2877	12633 Challenger Parkway Suite 230 Orlando, FL 32826	www.dyncorp.com
Intelligence architecture training and sims	Dynetics, Inc	(256) 922-9230	PO Box 5500 Huntsville, AL 35814	www.dynetics.com
Staff methodology and info management	General Dynamics	(703) 876-3000	3190 Fairview Park Dr Falls Church, VA 22042-2523	www.generaldynamics.com
Vehicle position and attitude	Analytical Graphics, Inc.	(800) 220-4785	40 General Warren Blvd, Malvern, PA 19355	www.stk.com
Motion tracking	Ascension Technology Corporation	(802) 893-6657	PO Box 527, Burlington, VT 05402	www.ascensimon-tech.com
Command and control	BARCO Control Rooms	(770) 218-3200	32340 Town Point Drive, Kennesaw GA 30144	www.barco.com
Imagery and information	DigitalGlobe	(303) 682-3800	1900 Pike Road, Longmount, CO 80501	www.digitalglobe.com